PROPOSED FINAL

SAN FRANCISCO BAY AREA

REDESIGNATION REQUEST AND MAINTENANCE PLAN

FOR THE

NATIONAL CARBON MONOXIDE STANDARD

(CARBON MONOXIDE MAINTENANCE PLAN)

JULY 1994

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ABBREVIATIONS AND TERMINOLOGY

ABAG	Association of Bay Area Governments
AIRS	Air Information Retrieval System
APCO	Air Pollution Control Officer
ARB	(California) Air Resources Board
AQP	(1982 Bay Area) Air Quality Plan
BAAQMD	Bay Area Air Quality Management District
BAR	Bureau of Automotive Repair
CAA	(Federal) Clean Air Act
CAAA	(Federal) Clean Air Act Amendments
CAP	(Bay Area 1991) Clean Air Plan
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
DOT	Department of Transportation
EIR	Environmental Impact Report
EITAC	Emission Inventory Technical Advisory Committee
EPA	(United States) Environmental Protection Agency
FHWA	Federal Highway Administration
FIP	Federal Implementation Plan
FMVCP	Federal Motor Vehicle Control Program
FTA	Federal Transit Administration
HOV	High Occupancy Vehicle
I & M	Inspection and Maintenance Program
LDT	Light-Duty Trucks
MTC	Metropolitan Transportation Commission
NAMS	National Air Monitoring Stations
NAAQS	National Ambient Air Quality Standards
NO_X	Oxides of Nitrogen
NSR	New Source Review
O_3	Ozone
PM_{10}	Particulate Matter of Less Than 10 Microns
pphm	parts per hundred million
ppm	parts per million
PST	Pacific Standard Time
RFP	Reasonable Further Progress
ROG	Reactive Organic Gases
RTP	Regional Transportation Plan
RVP	Reid Vapor Pressure
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations
TCMs	Transportation Control Measures
TIP	Transportation Improvement Program
TPD	tons per day
TSM	Transportation System Management
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

SECTION 1: INTRODUCTION

This is a Redesignation Request and Maintenance Plan (herein the "CO Maintenance Plan") to document and ensure continuing attainment of the national ambient air quality standard for carbon monoxide (CO) in the San Francisco Bay Area. This Plan is intended to comply with requirements of the federal Clean Air Act, as amended in 1990, and with relevant procedures and policies of the U.S. Environmental Protection Agency (EPA).

Carbon monoxide is an odorless, colorless gas emitted in the exhaust of motor vehicles and other combustion sources where there is incomplete burning of fossil fuels. Sources include automobiles, buses, trucks, small engines, and some industrial processes. High concentrations may occur in confined spaces like parking garages and poorly ventilated tunnels. Also, elevated concentrations may occur in ambient air during adverse weather conditions. In the Bay Area, such conditions occur on cold, windless winter nights.

Carbon monoxide reduces the ability of blood to carry oxygen to vital tissues, affecting primarily the cardiovascular and nervous systems. Lower concentrations have been shown to adversely affect individuals with heart disease (e.g., angina) and to decrease exercise performance in young, healthy persons. Higher concentrations can cause dizziness, headaches and fatigue.

The EPA has set primary national ambient air quality standards (NAAQS) for carbon monoxide and other[1] air pollutants to define the levels considered safe for human health. The NAAQS for carbon monoxide are set at 35 parts per million (ppm) for a one-hour averaging time and 9 ppm for an eight-hour averaging time. EPA procedures for determining attainment of the standard require representative air quality measurements showing two years of clean air, with no more than one exceedance of the standard per year at any air monitoring site.

The Bay Area Air Quality Management District (BAAQMD or District) was established in 1955 by the California Legislature to control air pollution in the counties around San Francisco Bay.[2] The BAAQMD has measured carbon monoxide levels for many years and now has 17 monitoring sites with certified instruments measuring carbon monoxide. Because past carbon monoxide

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[1] Ozone, particulate matter, sulfur dioxide, nitrogen dioxide and lead are other pollutants for which NAAQS have been established.

[2] Counties in the San Francisco Bay Area Air Basin include all of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo and Santa Clara counties, and the western part of Solano and the southern part of Sonoma counties.

measurements showed violations of the eight-hour national standard[3], the Bay Area was designated by EPA as a nonattainment area, and was subject to various planning and air pollution control requirements.

Many federal, State and regional control programs have been implemented over the years to reduce carbon monoxide levels. BAAQMD air monitoring records for the past two years (1992 and 1993) show carbon monoxide levels low enough to qualify the region for attainment status with respect to the national standard.[4] This document is part of the formal procedure by which the Bay Area regional planning agencies[5] request redesignation to attainment status and demonstrate that carbon monoxide will not increase to a level above the eight-hour national standard in the future.

This CO Maintenance Plan will be adopted by the three regional agencies and submitted to the California Air Resources Board (ARB) for subsequent transmittal to EPA.

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[3] The one-hour national standard has not been exceeded since 1985.

[4] This plan focuses on the National Ambient Air Quality Standards for CO. The State of California set its own ambient air quality standards. California's standards for carbon monoxide are 20 parts per million for a one-hour averaging time and 9.0 ppm for an eight-hour averaging time. There is a separate State air quality planning process outlined in the 1988 California Clean Air Act and subsequent amendments.

[5] The regional planning agencies (the BAAQMD, the Association of Bay Area Governments and the Metropolitan Transportation Commission) have been designated co-lead agencies for federal air quality planning in the San Francisco Bay Area.

SECTION 2:
NATIONAL AMBIENT AIR QUALITY STANDARDS FOR CARBON MONOXIDE

This CO Maintenance Plan addresses the ambient air quality standards for carbon monoxide set by EPA, under the provisions of the *Clean Air Act of 1970* and subsequent amendments.

The harmful effects of air pollution have been recognized for many years, but scientific studies and legal procedures have been developed only in recent decades to define specific pollutants. Carbon monoxide is largely generated by combustion of gasoline in motor vehicle engines. The *1965 Clean Air Act Amendments* gave the U.S. Secretary of Health, Education and Welfare authority to publish and enforce federal emission standards for new motor vehicles. The *1970 Clean Air Act Amendments* transferred this authority to the EPA Administrator, and called for development of air quality criteria and control technique documents for carbon monoxide and other air pollutants. In 1969, the State of California set a carbon monoxide standard, and in 1971 the EPA set national ambient air quality standards for several air pollutants, including carbon monoxide. The current national standard, the subject of this Plan[6], is 9 parts per million of carbon monoxide in ambient air, based on an eight-hour averaging time for the measurement. This is usually shortened to 9 parts per million, or simply 9 ppm.[7]

There are both primary and secondary air quality standards. Primary standards are set to protect human health, with a margin of safety to protect the more sensitive persons in the population such as the very young, the elderly, and the ill. Secondary standards are set to protect property, materials, aesthetic values and general welfare. Primary and secondary standards for a pollutant may be set at the same or different levels. For carbon monoxide, there are no secondary standards since the principal effects of carbon monoxide are on human health. The numerical levels of the standards are subject to change, based on new scientific evidence (or new interpretation of existing evidence) summarized in air quality criteria documents. The criteria and the standards are periodically reviewed, but changes

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[6] The current California standard for carbon monoxide is 9.0 ppm, based on the State's independent interpretation of medical and scientific evidence. The BAAQMD has prepared and adopted the *1991 Clean Air Plan* (CAP) to reduce carbon monoxide levels and maintain progress toward attainment of the more stringent State ozone standard. The 1992-93 air monitoring record shows that the Bay Area also attained the State CO standard, but the '91 CAP will be updated in 1994 for ozone. Adoption is expected by December. That effort is independent of this CO Maintenance Plan for the eight-hour national carbon monoxide standard.

[7] EPA procedures specify rounding of monitored carbon monoxide concentrations. A reading of 9.4 ppm or less is rounded to 9 ppm, and is thus acceptable for attainment of the national eight-hour carbon monoxide standard.

are infrequent. The national primary eight-hour standard for carbon monoxide has been set at 9 ppm since 1985.

The formal statement of the national 8-hour carbon monoxide standard appears in the Code of Federal Regulations (40 CFR Part 50.8), which says:

- *The national primary ambient air quality standards for carbon monoxide are: (1) 9 parts per million (10 milligrams per cubic meter) for an 8-hour average concentration not to be exceeded more than once per year...*

Part 50.8 also provides references for methods for measuring carbon monoxide concentrations in ambient air, procedures for averaging data to determine an 8-hour concentration, and certain requirements regarding presentation of data. An EPA guidance document[8] calls for two complete consecutive calendar years of quality-assured monitoring data with no violations of the standard before an area can be considered to have attained the standard.

In general, showing "attainment" requires collecting representative air monitoring data using approved measuring instruments and procedures, with adequate quality assurance and quality control. The two most recent calendar years' measurements are examined with special attention to any measurements that result in an eight-hour average higher than the national standard. All locations within an area have to meet the standard, so a determination is made for each monitoring site. The number of exceedances each year must be zero or one. In practice, no monitor can have more than one day with an exceedance of 9 ppm during either of the two most recent calendar-years. Air quality measurements in the Bay Area satisfy these requirements, as shown in Section 3, "Attainment Demonstration, Ambient Air Quality Monitoring Data—1992–1993."

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[8] J. Calcagni, September 4, 1992.

SECTION 3:
ATTAINMENT DEMONSTRATION

Ambient Air Quality Monitoring Data -- 1992-1993

Monitoring Network

The Bay Area has a comprehensive network consisting of 17 stations for carbon monoxide monitoring. In federal regulations, the network is comprised of both "NAMS" and "SLAMS" monitoring stations, where NAMS is the acronym for National Air Monitoring Stations and SLAMS is an acronym for State and Local Air Monitoring Stations. The BAAQMD began carbon monoxide monitoring in a few places in 1962, and a larger network was established in 1969. Eight-hour carbon monoxide levels as high as 20 ppm were measured in San Francisco in the 1970s. Significant improvements have been made over the years in instrumentation, area coverage, quality assurance, and data processing procedures. The EPA provided funding for some of these improvements. The present network provides good geographical coverage and includes areas adjacent to high volume freeways and streets, populated areas, and downwind high concentration areas. The monitors are carefully maintained and operated, with adequate quality assurance procedures. The system has scored well on audits conducted by the EPA and ARB. A map of the network is provided in Appendix A, "Air Monitoring Network," along with a list of stations, addresses, monitoring objectives, and scales of representativeness. Appendix B, "Historical Carbon Monoxide Trends," provides a discussion of carbon monoxide trends from the late-1970s to the present.

Carbon monoxide monitors run continuously, and eight-hour averages are derived electronically. After review and quality assurance procedures are completed, the SLAMS data are reported from BAAQMD to ARB and thence to the national ambient air monitoring data network that is part of "AIRS," the Air Information Retrieval System maintained by EPA. Formal determinations of attainment/nonattainment status and nonattainment classifications by EPA are based on data in the AIRS data base.

Recent Carbon Monoxide Monitoring Trends

Table 1 presents information on exceedances of the national eight-hour standard for 1986–93 and maximum eight-hour carbon monoxide concentrations in the Bay Area for 1992 and 1993. From 1992 through 1993, no District monitor registered an exceedance of the national carbon monoxide standard. More detail on the air monitoring data is provided in Appendix B, "Historical Carbon Monoxide Trends / Air Monitoring Data."

Table 1

San Francisco Bay Area Ambient Carbon Monoxide Measurements Exceedances of the National 8-Hour Standard and Maximum Concentrations

	Number of Exceedances of the National 8-Hour CO Standard[a]								Maximum 8-Hour Concentration	
Site	'86	'87	'88	'89	'90	'91	'92	'93	1992	1993
Fremont	0	0	0	0	0	0	0	0	4.1	3.2
Oakland	0	0	0	0	0	0	0	0	4.5	4.8
Livermore	0	0	0	0	0	0	0	0	4.3	3.9
Pittsburg	0	0	0	0	0	0	0	0	3.8	2.9
Richmond	0	0	0	0	0	0	0	0	4.0	3.4
Concord	0	0	0	0	0	0	0	0	5.3	4.9
Bethel Island	–[b]	0	0	0	0	0	0	0	3.9	1.7
San Rafael	0	0	0	0	0	0	0	0	4.8	3.8
Napa	0	0	0	0	0	0	0	0	5.1	4.4
S.F. - Ellis Street	2	1	1	0	0	0	0	0	7.4	6.8
S.F. - Arkansas Street	0	0	0	0	0	0	0	0	6.4	5.0
Redwood City	0	0	0	0	0	0	0	0	4.9	5.9
San Jose - 4th Street	4	0	2	6	2	4	0	0	7.3	6.6
San Jose - San Carlos St.	–[b]	–[b]	–[b]	–[b]	0	0	0	0	7.5	6.5
Gilroy	0	0	0	0	0	0	0	0	3.5	3.0
Vallejo	4	0	1	2	0	0	0	0	6.4	7.9
Santa Rosa	0	0	0	0	0	0	0	0	4.0	3.7

Notes:

[a] The national CO standard is exceeded if any measured CO value exceeds 9.4 ppm.

[b] Site not in operation during that year.

The eight-hour national standard allows up to one expected[9] exceedance per year at any one site over two complete, consecutive calendar years (i.e., zero or one exceedance per year). Based on the monitoring data, the Bay Area has met the eight-hour national carbon monoxide standard. In the "attainment" years (1992 and 1993), no single monitor had an exceedance of the eight-hour national carbon monoxide standard.

[9] The statistical term "expected" is used to allow for computational corrections in the monitoring data arising from missing values or incomplete sampling.

Permanent and Enforceable Improvement in Air Quality

EPA guidance (Calcagni, September 4, 1992) says that the State must be able to reasonably attribute the improvement in air quality to emission reductions which are permanent and enforceable. Economic downturns and/or unusual meteorology are cited as factors which might result in lower carbon monoxide concentrations and an attainment record that is "artificial." That is, the attainment might not be sustainable through a return to "normal" economic conditions and meteorology.

Economic Effects

Trend data were compiled for vehicle miles traveled (VMT) as a viable surrogate for the overall level of economic activity in a 25 square kilometer area centered on downtown San Jose, where the region's highest carbon monoxide concentrations are found (Table 2).

Table 2:
Downtown* San Jose Area Vehicle Miles Traveled (VMT)

(In Thousands, State and Non-State Highways)

Year	Daily VMT	Annual Growth Rate
1980	892.4	Baseline
1981	920.4	3.14%
1982	948.0	3.00%
1983	975.2	2.87%
1984	1,002.1	2.75%
1985	1,028.5	2.64%
1986	1,054.5	2.53%
1987	1,080.1	2.43%
1988	1,105.4	2.34%
1989	1,130.3	2.25%
1990	1,154.8	2.18%
1991	1,211.6	4.91%
1992	1,271.1	4.91%
1993	1,333.4	4.90%
1994	1,398.7	4.90%
1995	1,467.2	4.89%
Pre-Attainment	(1980-1991)	2.82%
Attainment Period	(1992-1993)	4.91%
Forecast	(1994-1995)	4.90%

Notes:

* "Downtown Area" is defined as the 25 square kilometer area identified in the *1982 Air Quality Plan.*

Sources:

(1) Personal conversation between David Marshall, BAAQMD, and Charles Purvis, MTC, May 11, 1994.

(2) VMT data for 1982, 1990 and 1996 based on MTC travel demand modeling. Interpolation/backcasting of other years based on San Jose Sphere of Influence employment shown in *Projections '94*, ABAG, December 1993.

Because motor vehicles produce over two-thirds of carbon monoxide emissions, VMT is a very good indicator of the effects of economic conditions on emissions.

Table 2 shows VMT estimates for 1980 through 1995. Although there may have been a decline in economic activity in Santa Clara County in the early 1990's, VMT in downtown San Jose increased rapidly in recent years. The increase in travel is due, in part, to transportation improvements in the area, notably opening of the Guadalupe Freeway. Therefore, travel-related emissions did not actually decrease due to economic conditions, and were not likely to have affected the region's attainment of the eight-hour national carbon monoxide standard.

Effects of Weather

In recent years prior to attainment, exceedances of the 8-hour national carbon monoxide standard could be correlated with winter (November through February) days with a high "stability factor"[10] in downtown San Jose.[11] Meteorological conditions in 1992 and 1993 provided many opportunities for exceedances, yet none resulted.

Table 3:
Comparison of 1992-93 San Jose High Stability Factors/CO Standard Exceedances with Historical High Stability Factors/CO Standard Exceedances

Calendar Years	Number of Days Stability* > 9	Number of Days Stability* > 14	Exceedances of the National CO Standard
Pre-Attainment Years:			
1984 & 1985	57	31	21
1985 & 1986	71	42	20
1986 & 1987	42	22	4
1987 & 1988	43	17	2
1988 & 1989	81	44	8
1989 & 1990	88	49	8
1990 & 1991	89	42	8
1991 & 1992	82	39	6
Attainment Years:			
1992 & 1993	**59**	**27**	**0**

Notes:

* "Stability" is defined as the temperature (in degrees Fahrenheit) at 2,500 feet elevation (derived from a weather balloon "sounding"), minus that measured at the surface (U.S. Weather Service office in San Jose). Stability is indicative of low-level inversion strength. Vertical mixing of air decreases with an increase in the algebraic value of stability.

Source:

Compiled from data in monthly *Contaminant and Weather Summary* reports, Bay Area Air Quality Management District, Technical Services Division.

Table 3 compares the number of days that high stability factors were present with the number of exceedances of the eight-hour national carbon monoxide standard.

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[10] A monitoring site's *stability factor* is a statistical representation of low-level (less than 2,500 feet above sea level) inversion strength and the amount of vertical mixing of air in the area. High stability factors (10 or more) represent the presence of a strong inversion layer and very little mixing of air. These conditions are conducive to poor air quality, and hence potential exceedances.

[11] Downtown San Jose stability factor readings were taken at a station operated by the U. S. Department of Commerce, National Weather Service.

Days with high stability factors represent opportunities for carbon monoxide standard exceedances. In every two year period since 1984, there have been over 40 days when the stability factor in San Jose exceeded 9, and over 15 days when the stability factor exceeded 14. The 1992-93 "attainment window" was no exception -- there were 59 days when the stability factor in San Jose exceeded 9 and 27 days when the stability factor exceeded 14. Even with this many opportunities for an exceedance, none were recorded. Thus, the Bay Area's attainment of the national carbon monoxide standard was not a result of favorable weather. Attainment, evidenced by the monitoring data, was due to implementation of control measures resulting in permanent and enforceable emission reductions, as discussed in more detail in the following section.

Permanent and Enforceable Emissions Reductions

The *1982 Air Quality Plan* for the Bay Area projected attainment of the eight-hour national ambient air quality standard for carbon monoxide by 1987, if all control measures in the Plan were successfully implemented. The CO control strategy included the motor vehicle inspection and maintenance program and implementation of transportation control measures (TCMs) in two "hotspot" areas - San Jose and Oakland.

Because motor vehicle inspection and maintenance program benefits were less than expected, and there were some deficiencies in the TCMs, the standard was not attained in 1987. The 1987 Reasonable Further Progress (RFP) report showed a regionwide shortfall in CO emission reductions of 4 tons/day from TCMs. The California Motor Vehicle Inspection and Maintenance (I&M) Program Review Committee reported a 142 tons/day shortfall in Bay Area CO emissions reductions for I&M.[12] Improvements to the I&M program in 1990 resulted in an additional 311-325 tons/day reduction in CO emissions.[13] In 1990, MTC adopted sixteen additional "contingency" TCMs. (A 1990 court order precipitated the process). The contingency TCMs were expected to achieve a 66 tons per day reduction in CO emissions. Furthermore, as required by the 1990 CAAA, a wintertime oxygenated fuels program (2.0% oxygen content by weight) was implemented in the Bay Area in late 1992 to achieve additional emission reductions.[14] During the attainment years (1992-1993), the oxygenated fuels program achieved a 214-224 tons per day

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[12]Evaluation of the California Smog Check Program Technical Appendix, California I&M Review Committee, April 1987.

[13]California I&M Review Committee's Fourth Report to the Legislature, February 1993.

[14] The *1990 Clean Air Act Amendments* required carbon monoxide nonattainment areas with a design value greater than 9.5 to implement an oxygenated fuels program with a minimum of 2.7% oxygen content by weight. An analysis prepared by the California Air Resources Board demonstrated that a 2.7% oxygen content would increase oxides of nitrogen and might delay attainment of the national and state ozone standards in certain areas of the state. Thus, ARB applied for and obtained a waiver from EPA to implement a program with a 2.0% oxygen content.

reduction in carbon monoxide.[15] Thus, attainment of the standard was due to permanent and enforceable emission reductions.

For reference, the projected change in the carbon monoxide inventory between 1990 and 1995 is a reduction of 901 tons/day (see Table 4 in Maintenance Demonstration section). This level reflects growth in emissions from an increase in vehicle miles traveled as well as the reduction in emissions due to *all* control measures—TCMs, I & M program enhancements and oxygenated fuels. The net effect is that these control measures reduced emissions below the attainment level.

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[15] California Phase 2 Reformulated Gasoline Specifications -- Volume 2 -- Proposed Regulation for California Wintertime Oxygenates Program -- Staff Report, California Air Resources Board, October 4, 1991.

SECTION 4: REDESIGNATION REQUEST

The three designated co-lead regional planning agencies--ABAG, BAAQMD and MTC--request that EPA redesignate the San Francisco Bay Area to attainment status with respect to the eight-hour national ambient air quality standard for carbon monoxide. This CO Redesignation Request and Maintenance Plan addresses the criteria presented in Section 107(d)(3)(E) of the Clean Air Act:

(1) Verification that the National Ambient Air Quality Standard (NAAQS) has been attained. Attainment of the NAAQS in the Bay Area is discussed in Section 3 of this document, "Attainment Demonstration - Ambient Air Quality Monitoring Data -- 1992-1993."

(2) State Implementation Plan fully approved by EPA under Section 110(k). The *1982 Bay Area Air Quality Plan* (AQP), the SIP for the Bay Area, and its compliance with Section 110(k) of the CAA is addressed in Section 7 of this document, "Administrative Requirements, Approved SIP."

(3) Improvements in air quality from permanent and enforceable reductions in emissions. The improvements in air quality in the Bay Area are due to permanent and enforceable reductions in emissions as discussed in Section 3 of this document, "Permanent and Enforceable Improvement in Air Quality."

(4) All applicable requirements have been met as defined in Section 110 and Part D of the CAA. Compliance with Section 110, Part D, Section 172(c) and Section 176(c)(4) of the CAA is discussed in Section 7 of this document, "Administrative Requirements," within the subsections "Previous/Existing SIP Requirements" and "Conformity Requirements."

(5) EPA has fully approved a CO Maintenance Plan, including a contingency plan, as defined in Section 175 of the CAA. The five elements of a maintenance plan required under the CAA are provided in the sections of this document as indicated below:

Required Element	Section of this Plan
Attainment Inventory	Sect. 5: Maintenance Demonstration
Maintenance Demonstration	Sect. 5: Maintenance Demonstration
Monitoring Network	Sect. 7: Administrative Requirements
Verification of Continued Attainment	Sect. 7: Administrative Requirements
Contingency Plan	Sect. 6: Contingency Measures

SECTION 5: MAINTENANCE DEMONSTRATION

Attainment Inventory and Inventory Projections

An emission inventory is an itemized list of emission estimates for sources of air pollution in a given area for a specified time period. Present and future year inventories are critical components of air quality planning and modeling. The ultimate goal of the planning process is to identify and achieve an emission pattern which does not result in violation of ambient standards.

The BAAQMD's emission inventory is divided into stationary sources (e.g., refineries) and mobile sources (e.g., cars). Stationary sources are further subdivided into **point** (e.g., "smokestack"), and **area** (e.g., use of consumer products and numerous very small point sources) emissions. The actual 1990-2010 Bay Area carbon monoxide emissions are summarized in Table 4 and Figure 1. The emissions are in tons per carbon monoxide season day. The preparation of the 1990 inventory is described in Appendix C, "Emission Inventory."

The attainment time window, when air monitoring results showed attainment of the standard, was 1992 through 1993. The attainment inventory must have been reached, therefore, in 1992. Table 4 shows carbon monoxide emissions were 3,779 tons per day in 1990 and are projected to be reduced to 2,878 tons per day in 1995. The 1992 "attainment" emissions level is 3,187 tons per day. Additional details on the inventory are provided in Appendix C.

Table 4

Bay Area Baseline* Carbon Monoxide Emission Inventory Projections
Winter Planning Inventory** (Tons/Day)

Base Year 1990 / Winter Operating Day	**1990**	**1992**	**1995**	**2000**	**2005**	**2010**
Industrial/Commercial Processes/Facilities						
Petroleum Refining Facilities	1	1	1	1	1	1
Chemical Manufacturing Facilities	28	27	26	28	30	32
Combustion/Stationary Sources						
Fuel Combustion	373	383	394	413	427	441
Burning of Waste Material	3	3	3	3	3	3
Subtotal (District Jurisdiction)	**407**	**417**	**427**	**448**	**464**	**480**
Combustion - Mobile Sources						
On-Road Motor Vehicles**	2,910	2,289	1,934	1,399	993	786
Off-Highway Mobile Sources	407	415	458	473	493	508
Aircraft	53	55	58	62	65	68
Consumer Solvents & Other Sources	4	4	4	4	5	5
Total	**3,779**	**3,187**	**2,878**	**2,384**	**2,018**	**1,843**

Notes:

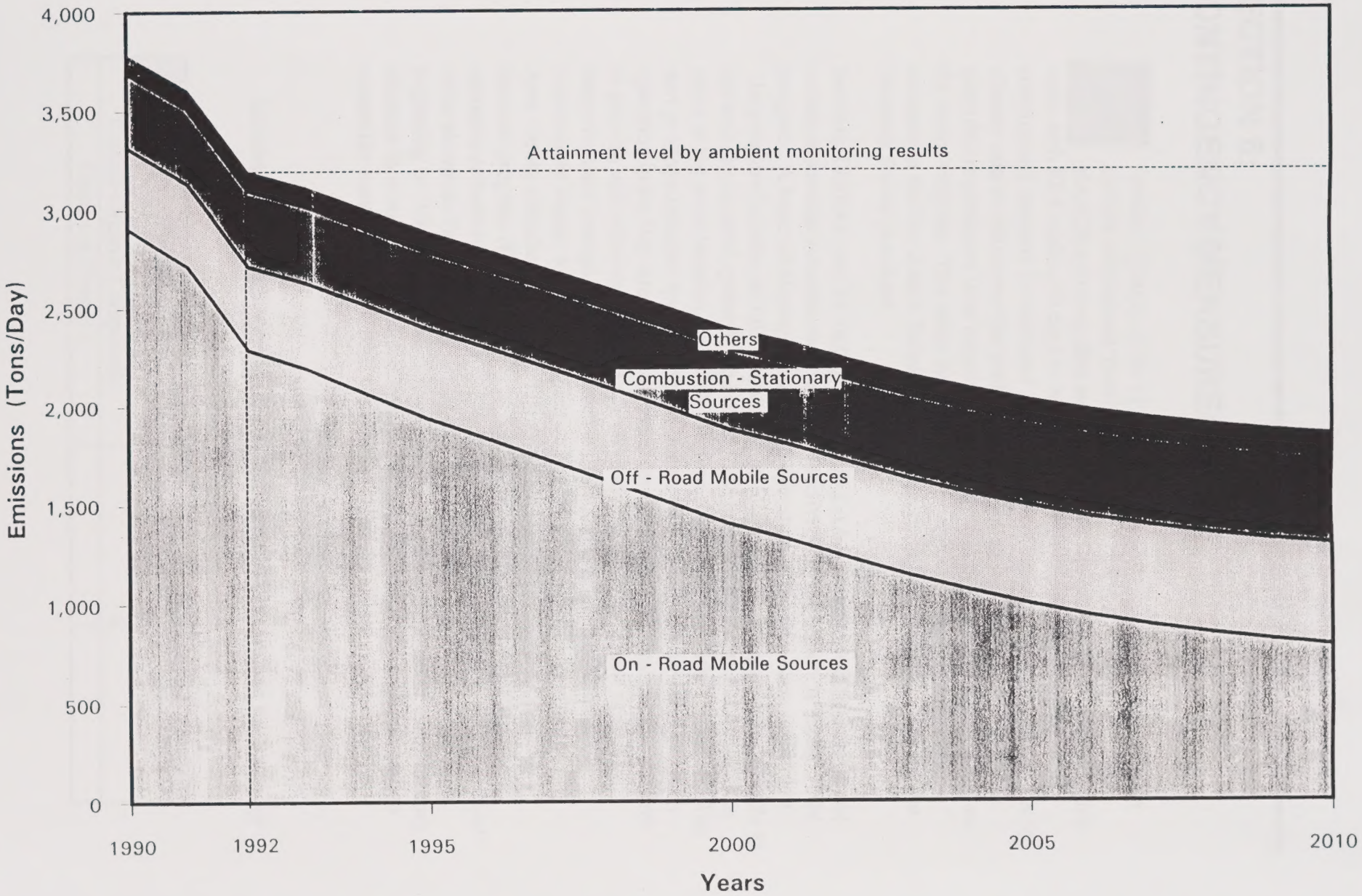
* Baseline projections are made assuming implementation of all control measures already adopted at federal, state and regional levels as of December 31, 1993. Does not include 3 tpd pre-1990 banking credit.

** Based on emissions factors contained in Final EMFAC7F Release 1.1, ARB, January 1994.

Entries are rounded to the nearest whole number; totals may not equal to sums of column entries.

Figure 1 - Bay Area Emmission Inventory Projections 1990-2010

Carbon Monoxide (Winter Season)



SECTION 6: CONTINGENCY MEASURES

Section 175A(d) of the 1990 CAAA requires that a maintenance plan include contingency provisions. In the event that a violation of the NAAQS occurred after redesignation to attainment, District staff would meet with EPA within 30 days to determine whether implementation of a contingency measure is warranted or whether turnover of the motor vehicle fleet to cleaner cars would correct the problem. The contingency measure identified to meet this requirement is an improved inspection and maintenance (I&M) program for motor vehicles. This same improved I&M program is also a contingency measure in the Bay Area's *Redesignation Request and Maintenance Plan for the National Ozone Standard.*

Sections 182(b)(4) and 187(a)(4) of the 1990 CAAA require moderate ozone and carbon monoxide nonattainment areas, respectively, to implement a "basic" I&M program. A basic I&M program has been operating in the Bay Area since 1984. The program includes an idle test and visual inspection for tampering and defects to the emission control systems. The basic I&M program allows test and repairs to occur at the same location. In 1994, California adopted a new I&M program. The new program includes specific improvements to the current basic I&M program operating in the Bay Area (e.g., increased repair cost waiver limits, improvements to training and enforcement), and allows moderate areas to request other improvements (except centralized, test-only requirements). The Bureau of Automotive Repair will begin implementing "improved basic" I&M in the Bay Area during calendar year 1995. The available improvements are expected to increase program effectiveness by at least 5 percentage points. Incremental emission reductions (above and beyond the current, basic program) will be at least those shown in Table 5. The initiation of improved basic I&M in the Bay Area beginning in 1995 constitutes early adoption and implementation of a contingency measure to ensure continued maintenance of both the national ozone and carbon monoxide standards.

Table 5

Additional Emission Reductions from Improved I&M Program in the Bay Area

Pollutant	Additional Reductions (Tons/Day)
Carbon Monoxide	**80**
Volatile Organic Compounds	8
Oxides of Nitrogen	7

SECTION 7: ADMINISTRATIVE REQUIREMENTS

Previous/Existing SIP Requirements

Compliance with the CAA SIP Planning Requirements

Based on the information presented below, the Bay Area has complied with State Implementation Plan (SIP) planning requirements specified in Section 110(k) of the CAA. The SIP, the document guiding the region toward attainment of the eight-hour national carbon monoxide standard, is embodied in the *1982 Bay Area Air Quality Plan* and all subsequent revisions of the Plan, through the date of submittal of this document to EPA.

Approved SIP

The 1982 Plan

The EPA-approved SIP for the Bay Area is the *1982 Air Quality Plan.* The notice of final rulemaking, approving this plan, appeared in the *Federal Register* on December 28, 1983, and approved all portions of the 1982 Plan except the vehicle inspection and maintenance program elements, which were approved in 1984.

The 1982 Plan identified a control strategy to attain the eight-hour national carbon monoxide standard. That control strategy relied on implementation of twelve mitigation measures for the region, five for downtown San Jose, and three for the Oakland central business district. There were four contingency measures identified for downtown San Jose and three for the Oakland central business district. Many of the mitigation measures were already programmed and thus considered part of the 1987 "baseline". The motor vehicle inspection and maintenance program, combined with a Santa Clara County commute transportation program, were proposed to achieve the necessary emission reductions to attain the standard.

The twelve original transportation control measures (TCM) contained in the 1982 Plan are listed in Table 6, along with sixteen additional contingency TCMs adopted by MTC in February 1990. All of the TCMs are being implemented by the Metropolitan Transportation Commission in association with State and local agencies.

Table 6:
Transportation Control Measures

Original Transportation Control Measures from 1982 Plan	
TCM 1	Reaffirm commitment to 28% transit ridership increase between 1987 and 1983.
TCM 2	Support post-1983 improvements in the operators' five-year plans, and after consultation with the operators, adopt ridership increase target for the period 1983 through 1987.
TCM 3	Seek to expand and improve public transit beyond committed levels.
TCM 4	High occupancy vehicle (HOV) lanes and ramp metering.
TCM 5	Support RIDES' efforts.
TCM 6	Continue efforts to obtain funding to support long-range transit improvements.
TCM 7	Preferential parking.
TCM 8	Shared-use park and ride lots.
TCM 9	Expand commute alternatives program.
TCM 10	Information program for local governments.
TCM 11	Gasoline Conservation Awareness Program (GasCAP).
TCM 12	Santa Clara County commuter transportation program.
Contingency Plan TCMs (Added by Court Order in 1990)	
TCM 13	Increase bridge tolls to $1.00 on all bridges.
TCM 14	Bay Bridge surcharge of $1.00.
TCM 15	Increase state gas tax by 9 cents.
TCM 16	Implement MTC Resolution 1876, revised - New Rail Starts.
TCM 17	Continue post-earthquake transit services.
TCM 18	Sacramento to Bay Area Amtrak service.
TCM 19	Upgrade CalTrain service.
TCM 20	Regional HOV system plan.
TCM 21	Regional transit coordination.
TCM 22	Expand regional transit connection ticket distribution.
TCM 23	Employer audits.
TCM 24	Expand signal timing program to new cities.
TCM 25	Maintain existing signal timing programs.
TCM 26	Incident management on Bay Area freeways.
TCM 27	Update MTC guidance on development of local TSM programs.
TCM 28	Local TSM initiatives.

Source:

FY 1992-96 Transportation Improvement Program for the nine-county San Francisco Bay Area, Volume 3, Air Quality Assessment, MTC, September 25, 1991.

SIP Planning Between 1987 and 1990

The 1982 Plan responded to a requirement of the CAA for nonattainment areas to prepare plans showing attainment of the NAAQS by December 31, 1987. The CAA did not specify what post-1987 planning requirements existed for areas which

did not attain the standards by 1987. In the interim, between the end of 1987 and the adoption of the *Clean Air Act Amendments* in November 1990, planning for attainment in nonattainment areas was guided by EPA requirements in the form of "SIP calls." These SIP calls constitute revisions in the SIP showing reasonable further progress (RFP) toward attaining the standards. For the Bay Area, there were no carbon monoxide-related SIP calls between 1987 and the present. In February 1990, MTC adopted the sixteen contingency TCMs shown above in Table 6.

SIP Planning Requirements of the 1990 CAAA

The enactment of the 1990 CAAA established new SIP planning requirements. Based on the Bay Area's design value of 11.8 parts per million of carbon monoxide in ambient air, and previous steps California has taken to control air pollution, only a few CO requirements of the 1990 CAAA apply to the Bay Area:

- *Submit a 1990 emissions inventory by November 15, 1992 and revise every three years thereafter until attainment.*

  ARB submitted a statewide 1990 carbon monoxide emission inventory. Approval of this CO Maintenance Plan by EPA by November 15, 1995 will eliminate the need for revision and resubmittal of the inventory, as required by CAAA Section 187(a)(5).

- *Submit a State Implementation Plan (SIP) revision requiring gasoline with no less than 2.7 percent oxygen content in the winter months.*

  ARB obtained a waiver from the 2.7 percent requirement. A 1.8 to 2.2 percent oxygen content was determined to be preferable for California. In the Bay Area, sale of oxygenated fuel began November 1, 1992 and ended January 31, 1993. Sale resumed for the period October 1, 1993 through January 31, 1994. The wintertime oxygenated fuels program will continue through 1996, at which time the requirement will be incorporated into California Phase II reformulated fuels.

- *Basic Motor Vehicle Inspection and Maintenance (I&M) Program*

  The current California "Smog Check" Program, with increased repair cost waiver limits adopted in 1994, meets the CAAA requirements. See Section –Contingency Measures above for details of I&M program improvements.

- *Part D New Source Review Permit Requirements.*

  The District's NSR program meets EPA requirements. In a December 1993 letter, EPA Region IX staff asked the District to revise its NSR program (Regulation 2, Rule 2) to require permit applicants to provide offsets when the CO emissions increase associated with a new source or modification exceeds 100 tons per year (550 pounds per day). The District was also

asked to continue requiring CO modeling of new/modified source permits to ensure that source offsets yield a net air quality benefit. The District will have completed revision of Regulation 2, Rule 2 to meet EPA requirements by June 15, 1994.

- *Contingency Measures.*

  The Bay Area has selected an improved basic I&M program as a contingency measure. See the Contingency Measures section above for details.[16]

Conformity Process

Section 176(c) of the 1990 Clean Air Act Amendments (CAAA) outlines the "conformity" provisions of the Act. Federal actions are required to conform to the State Implementation Plan's (SIP's) purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards and achieving expeditious attainment of these standards. Federal actions are differentiated into transportation-related actions by FHWA or FTA ("transportation conformity"), and all other federal actions ("general" conformity). This section provides a general overview of the transportation conformity requirements as conducted by MTC.

Transportation Conformity--MTC Resolution 2270

Resolution 2270 was adopted by MTC in 1991 to ensure that transportation plans, programs and projects do not interfere with timely attainment of air quality standards. Embodied in Resolution 2270 is a requirement that MTC will not approve any transportation plan, program, or project unless these activities conform to the purpose of the SIP. MTC's current conformity requirements include procedures from federal court orders relating to litigation over the *1982 Bay Area Air Quality Plan* (the '82 SIP for the Bay Area). The co-lead agencies[5] will adopt new conformity procedures based on EPA's final Transportation Conformity Regulation, promulgated November 24, 1993.

Transportation plan refers to MTC's *Regional Transportation Plan* (RTP), which is the 20-year master plan for the region and which provides policies, actions, and financial projections to guide transportation investment decisions. Transportation program refers to MTC's *Transportation Improvement Program* (TIP), which is a

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[16] Because the Bay Area is formally a moderate nonattainment area for the national carbon monoxide standard, the CAAA required adoption of contingency measures to take effect if the region does not attain the national CO standard by the 1995 deadline. The co-lead agencies adopted a CO Attainment-Contingency Plan in 1993 to comply with this requirement. The CO Attainment-Contingency Plan included an enhanced motor vehicle inspection and maintenance program as the contingency measure. At that time, California had not yet passed the 1994 I&M legislation which provides for improvements in the I&M program. As discussed in Section 6 above, the CO contingency measure for the Bay Area is the I&M improvements authorized by the 1994 legislation.

financially realistic set of highway and transit projects to be funded over the next seven years. The TIP includes all projects requiring federal funding, permits, or other approvals. A transportation project is any highway or transit project which is included in the RTP and TIP, requires federal funding or action, or is submitted to MTC for project review and fund application approval.

Proposed Revisions to Address Federal "Transportation Conformity" Regulation

On November 24, 1993, EPA published a Notice of Final Rule Making in the *Federal Register* which contained regulations for transportation conformity that apply to both nonattainment and maintenance areas. The regulation addresses two time periods: (1) the period up to the time when a revised SIP is approved by EPA (known as the "transitional period"), and (2) the period following SIP approval by EPA (known as the "budget period").

The Bay Area submitted two plans to ARB and EPA in 1993: a *Redesignation Request and Maintenance Plan for the National Ozone Standard* and a *Nonattainment Area and Rate-of-Progress Plan for the National Ozone Standard* (the Attainment Plan). Neither has been approved by EPA as of this writing. Thus the region is subject to transitional period requirements of the conformity regulation, which include a "build/no build" analysis and a budget test. Following EPA approval of the Redesignation Request or the Attainment Plan, whichever comes first, the region will be subject to only the budget test for plans (e.g., the RTP) and programs (e.g., the TIP).

Details of existing conformity criteria and procedures are described in MTC Resolution 2270 as explained above. These procedures are being revised to address requirements of the transportation conformity regulation. Proposed final public and agency consultation procedures, and proposed final transportation conformity procedures are included in a separate document, "Proposed Final Transportation Conformity and Interagency Consultation Procedures," available on request from MTC. The Proposed Final Transportation Conformity and Interagency Consultation Procedures are due in final form to ARB by September 25, 1994 and to EPA by November 25, 1994. These new procedures will supersede MTC Resolution 2270, once approved by EPA. **Redesignation to attainment for either ozone or carbon monoxide will not affect the proposed conformity procedures. The final conformity regulation applies to nonattainment and maintenance areas.**

General Conformity

A separate federal regulation requires general conformity procedures. On November 30, 1993, EPA published a Notice of Final Rule Making in the *Federal Register* which contained regulations for general conformity that apply to both nonattainment and maintenance areas. In the Bay Area, this regulation could impact very large non-transportation development and redevelopment projects or other very large projects involving a federal permit approval or funding. The co-

lead agencies are preparing a SIP submittal to address requirements of this regulation, "Proposed Final Bay Area General Conformity Procedures," are available upon request from ABAG. Final general conformity procedures are due to ARB and EPA by October 15, 1994 and November 30, 1994, respectively. As with the transportation conformity regulation, redesignation to attainment will not change the general conformity procedures.

Continued Air Monitoring and Verification of Continued Attainment

Continued Monitoring

The BAAQMD will continue to comply with Title III, Section 319, of the CAA requiring air quality monitoring. The District's monitoring stations are operated in compliance with EPA guidelines set forth in 40 CFR Part 58, "Ambient Air Quality Surveillance," and Appendices A through G of Part 58.

Verification of Continued Attainment

The BAAQMD will analyze annually the two most recent consecutive years to verify continued attainment of the national carbon monoxide standard, in accordance with 40 CFR Part 50 and EPA's redesignation guidance. In accordance with Title III, Section 319, of the CAA requirements, as interpreted in CFR 40 Part 58.26, the District will continue to submit to the EPA an annual report by July 1 of each year for data collected from January 1 to December 31 of the previous year. This information, with the annual report for the previous year, will provide the necessary information for determining whether the region continues to attain the national carbon monoxide standard.

Environmental Review / California Environmental Quality Act (CEQA) Compliance

The CO Maintenance Plan would not be subject to CEQA review because the Plan does not require the BAAQMD, MTC or ABAG to adopt or implement new programs in the region that could have a significant effect on the environment.

APPENDICES

APPENDIX A: AIR MONITORING NETWORK

The Bay Area has a comprehensive network consisting of 17 carbon monoxide monitoring stations (Figure A1 and Table A1). The network provides good geographical coverage, and includes both populated and expected high concentration areas. The system has scored well on audits conducted by both EPA and ARB. The monitors run continuously, and one-hour averages are derived electronically via data loggers and integrators. After review and quality assurance procedures are completed, eight hour averages are calculated by District staff. The carbon monoxide data are reported by BAAQMD to ARB and thence to the national ambient air monitoring data network that is part of "AIRS," the Air Information Retrieval System maintained by EPA. Attainment status and nonattainment classifications are based on data in the AIRS data base.

FIGURE A1
Bay Area Air Quality Management District
Carbon Monoxide Air Monitoring Stations

Table A1
Bay Area Air Quality Management District
Carbon Monoxide Air Monitoring Stations

Site Name and Address	County	AIRS ID#	Monitoring Desig/Scale/Obj[1]
Fremont - Chapel Way 40733 Chapel Way Fremont, CA 94538	Alameda	060011001	NAMS/NS/RC
Oakland - Alice St 822 Alice Street Oakland, CA 94607	Alameda	060010005	SLAMS/NS/RC
Livermore - Old First St 2614 Old First Street Livermore, CA 94550	Alameda	060010003	SLAMS/NS/RC
Pittsburg - W 10th St 583 W 10th Street Pittsburg, CA 94565	Contra Costa	060133001	SLAMS/NS/RC
Richmond - 13th St 1144 13th Street Richmond, CA 94806	Contra Costa	060130003	SLAMS/NS/RC
Concord - Treat Blvd 2975 Treat Boulevard Concord, CA 94518	Contra Costa	060130002	NAMS/NS/RC
Bethel Island 5551 Bethel Island Road Bethel Island, CA 94511	Contra Costa	060131002	SLAMS/NS/RC
San Rafael 534 4th Street San Rafael, CA 94901	Marin	060410001	SLAMS/NS/RC
Napa - Jefferson St 2552 Jefferson Street Napa, CA 94558	Napa	060550003	SLAMS/NS/RC

[1] Desig = Monitor Designation -
NAMS = National Ambient Air Monitoring Stations
SLAMS = State and Local Ambient Air Monitoring Stations
Scale = Monitoring Scale - MI = Microscale; MS = Middle Scale; NS = Neighborhood
Obj = Monitoring Objective - RC = Representative Concentrations;
HC = Highest Concentrations

Table A1 (Cont.)
Bay Area Air Quality Management District
Carbon Monoxide Air Monitoring Stations

Site Name and Address	County	AIRS ID#	Monitoring Desig/Scale/Obj[1]
San Francisco - Ellis St 939 Ellis Street San Francisco, CA 94109	San Francisco	060750003	NAMS/MI/HC
San Francisco - Arkansas St 10 Arkansas Street San Francisco, CA 94107	San Francisco	060750005	SLAMS/NS/RC
Redwood City 897 Barron Avenue Redwood City, CA 94063	San Mateo	060811001	SLAMS/NS/RC
San Jose - 4th St 120B N 4th Street San Jose, CA 95112	Santa Clara	060850004	NAMS/MI/HC
Gilroy - 9th St 9th & Prince Valle Street Gilroy, CA 95020	Santa Clara	060850002	SLAMS/NS/RC
San Jose - W San Carlos St 1866 W San Carlos Street San Jose, CA 95128	Santa Clara	060852004	SLAMS/MS/HC
Vallejo - Tuolumne St 304 Tuolumne Street Vallejo, CA 94590	Solano	060950004	SLAMS/NS/RC
Santa Rosa - 5th St 837 5th Street Santa Rosa, CA 95404	Sonoma	060970003	SLAMS/NS/RC

APPENDIX B: HISTORICAL CARBON MONOXIDE TRENDS

Ambient Carbon Monoxide Trends

Table B1 presents data on carbon monoxide (CO) values from the seventeen BAAQMD sites with monitoring records throughout most of the 1986-93 period. There are two NAAQS for carbon monoxide-- a 1-hour average standard of 35 parts per million (ppm) and an 8-hour standard of 9 ppm. The 1-hour standard has not been exceeded in the past 10 years, so the following discussion focuses on the 8-hour standard, for which the Bay Area is seeking redesignation to "Maintenance Area" status. The left-hand columns show the annual number of days that the 8-hour carbon monoxide standard was exceeded at various sites. Note that there were no exceedances in 1992 or 1993.

The right-hand columns of Table B1 show "design values" for 1986-88 and 1991-93. These design values represent estimates of the 8-hour averages that would be exceeded once per year on the average. The design values are declining over time at every site. Note also that every one of the 1991-93 design value estimates meets the national standard. These estimates are well below the standard and, with ongoing control efforts, there is little likelihood of any site exceeding the standard in the future.

TABLE B1

SAN FRANCISCO BAY AREA AMBIENT CARBON MONOXIDE MEASUREMENTS

Exceedances of the National 8-Hour Standard and Design Values

1986-93

Site	Number of Exceedances of the National 8-Hour CO Standard[a]								Design Value Estimates[b]	
	86	87	88	89	90	91	92	93	1986-88	1991-93
Fremont	0	0	0	0	0	0	0	0	5.1	4.2
Oakland	0	0	0	0	0	0	0	0	6.0	5.2
Livermore	0	0	0	0	0	0	0	0	4.2	3.7
Pittsburg	0	0	0	0	0	0	0	0	4.8	3.6
Richmond	0	0	0	0	0	0	0	0	4.2	3.5
Concord	0	0	0	0	0	0	0	0	5.6	4.6
Bethel Island	-[c]	0	0	0	0	0	0	0	1.9	1.9
San Rafael	0	0	0	0	0	0	0	0	5.0	4.6
Napa	0	0	0	0	0	0	0	0	5.8	5.1
S.F. - Ellis Street	2	1	1	0	0	0	0	0	7.8	5.9
S.F. - Arkansas Street	0	0	0	0	0	0	0	0	6.5	5.2
Redwood City	0	0	0	0	0	0	0	0	5.5	5.0
San Jose - 4th Street	4	0	2	6	2	4	0	0	9.5	8.7
San Jose - San Carlos St.	-[c]	-[c]	-[c]	-[c]	0	0	0	0	-[c]	7.2
Gilroy	0	0	0	0	0	0	0	0	3.2	2.8
Vallejo	4	0	1	2	0	0	0	0	9.6	7.6
Santa Rosa	0	0	0	0	0	0	0	0	4.7	3.7

[a] The national carbon monoxide standard is exceeded if any measured CO value exceeds 9.4 ppm.

[b] The design value for a site is the CO concentration that would be exceeded once per year on the average. Design value estimates computed from three years' worth of data using the ARB RECRATE program.

[c] Site not in operation during that year.

APPENDIX C: EMISSION INVENTORY

An emission inventory is an itemized list of emission estimates for sources of air pollution in a given area, for a specified time period. Present and future year inventories are critical components of air quality planning and modeling. The ultimate goal of the planning process is to identify and achieve an emission pattern which does not result in exceedance of ambient standards.

The BAAQMD began preparing emission inventories in 1957. Inventory estimates are prepared for many different air pollutants and their precursors. Only carbon monoxide results are reported here. The inventory is divided into stationary (point and area) and mobile source emissions. Stationary source emissions are calculated by the BAAQMD using various procedures. Emission computation methodology by source categories is set forth in the BAAQMD publication "Source Category Methodology." There are more than 900 different categories used in this inventory. The BAAQMD participates in the California Emission Inventory Technical Advisory Committee (EITAC) and maintains the best available inventory methodologies. The Bay Area carbon monoxide emissions for the years 1990, 1992 and 2010 are shown in Figure C1. The emissions by categories are shown in Table C1.

Figure C1
Bay Area Carbon Monoxide Emissions

Table C1
EMISSIONS BY MAJOR SOURCE CATEGORIES
Winter Season Inventory*

	Carbon Monoxide (tons/day)		
SOURCE CATEGORY	**1990**	**1992****	**2010****
INDUSTRIAL/COMMERCIAL			
Petroleum Refining Facilities	0.55	0.56	0.60
Other Industrial Processes	27.68	26.93	31.67
Subtotal	**28.2**	**27.5**	**32.3**
COMBUSTION - STATIONARY SOURCES			
FUELS COMBUSTION			
Domestic	334.66	342.65	396.72
Cogeneration	4.23	4.44	5.51
Power Plants	6.03	6.87	4.19
Oil Refineries External Combustion	6.17	6.20	5.85
Reciprocating Engines	5.66	5.86	6.80
Turbines	1.11	1.11	1.18
Other External Combustion	15.27	15.73	20.36
Subtotal	**373.2**	**383.0**	**440.7**
BURNING OF WASTE MATERIAL	2.82	2.89	3.43
COMBUSTION - MOBILE SOURCES			
OFF HIGHWAY MOBILE SOURCES			
Lawn, Garden and Other Utility Equipment	49.96	52.17	19.55
Transportation Refrigeration Units	.90	.92	1.07
Farm Equipment	4.90	5.08	6.48
Heavy Duty Industrial/Construction Equipment	6.98	7.39	9.72
Light Duty Industrial/Construction Equipment	240.15	253.95	332.06
Locomotive Operations	1.61	1.58	1.45
Off Road Motorcycles	8.06	7.40	3.57
All Terrain Vehicles	3.86	3.54	1.71
Four Wheel Drive Vehicles	1.80	1.76	1.44
Ships	1.03	1.06	1.36
Commercial Boats	1.30	1.34	1.70
Recreational Boats	86.62	89.25	127.93
Subtotal	**407.1**	**425.4**	**508.0**
AIRCRAFT			
Commercial Aircraft	15.57	16.30	21.09
General Aviation	22.96	24.14	32.14
Military Aircraft	14.51	14.51	14.51
Agricultural Aircraft	.07	.08	.09
Subtotal	**53.1**	**55.0**	**67.8**
ON ROAD MOTOR VEHICLES			
Light Duty Passenger	2159.88	1707.33	478.15
Light and Medium Duty Trucks	532.52	406.23	199.43
Heavy Duty Trucks	200.94	159.20	89.39
Heavy Duty Buses	4.31	4.40	5.10
Motorcycles--Non Catalytic	12.55	11.48	13.96
Subtotal	**2910.2**	**2288.6**	**786.0**
MISCELLANEOUS OTHER SOURCES	**4.00**	**4.10**	**4.70**
GRAND TOTAL	**3779**	**3187**	**1843**

* Base Year 1990

** Projections Based on 1990 Emission Inventory

Totals may not equal to sums of column entries due to rounding.

Stationary Source Emissions

Point Sources. Sources identified on an individual facility or source basis are called point sources. Refineries and industrial plants are examples of point sources. The emission characteristics of individual facilities vary widely and each facility is examined individually. The Permit Services Division of the BAAQMD collects and maintains detailed information on point sources. Almost all facilities emitting greater than 2.5 tons/year of any air pollutant are included in the computer data bank. The 1990 base year inventory accounts for about 3,900 facilities, with 20,000 different sources. There are about 35,000 different processes, because some sources have more than one process. Examples are: boilers burning different fuels, tanks storing different materials, and painting/printing operations using different coatings.

The data on the activity, seasonal variations, and hours of operation are collected at the process level from each facility. Parameters which affect the quantity of emissions are updated regularly. Emissions are calculated using the detailed data for each of the 7,000 processes listed as storage of organic liquid, and 10,000 processes listed as organic solvent users. The emissions from the combustion and other general processes are computed using generalized or specific emission factors. These factors are periodically reviewed and updated.

Area Sources. Those stationary sources which are not identified individually are called area sources. This term is sometimes extended to cover numerous small point sources such as dry cleaners or gas stations which are known (at least potentially) individually. It always includes the diverse, un-permitted small sources which individually do not emit significant amounts of pollutants but which together make an appreciable contribution to the emission inventory. Examples of area sources are residential heating and use of paints, varnishes and consumer products. Emissions from these sources are grouped into categories and calculated based on surrogate variables. Information on these surrogates is usually available for the State or by county. Emissions for some source categories are estimated by the California Air Resources Board (ARB) based on statewide data.

Many area source categories are further classified into sub-categories for better emission computation, regulation development, and future year projections. For example, emissions from aircraft categories are subdivided into various aircraft types at each of the airports in the Bay Area. Architectural coating categories are subdivided into various types of coatings and varnishes to account for varying solvent content.

Mobile Source Emissions

Mobile sources consist of on-road motor vehicles and other sources, such as ships, aircraft, garden and construction equipment. Emissions from on-road motor vehicles are a major portion of the emissions inventory, especially for carbon monoxide.

ARB uses EMFAC and BURDEN computer models for the development of the on-road motor vehicles emission inventory. EMFAC calculates emission rates for a variety of vehicle types (passenger cars, trucks, etc.), fuel, control technology and mode of operation. It also accounts for vehicle age, and operating conditions such as speed and temperature. Emission factors are produced for summer and winter operations to reflect the type of fuel in use, such as winter-time oxygenated fuel and the summer-time fuel which has lower volatility (lower RVP) than winter. Emission reductions resulting from California's Inspection and Maintenance ("Smog Check") program are incorporated. EMFAC7F version 1.1 was used for this inventory.

BURDEN uses emission factors from EMFAC and a large data base of activity for each county to calculate total daily motor vehicle emissions. The activity data are in the form of the number of in-use vehicles, number of cold and hot starts and vehicle miles traveled (VMT) for each vehicle type. The activity data for these calculations are developed using MTC's regional travel model and supplemental calculations. The planning version of BURDEN7F was used for this inventory, and is described under the Seasonal Inventory section.

Various methodologies are used for compilation of the remaining mobile sources. Emission factors and methodologies for these sources are provided by ARB and EPA. Aircraft mix and activity data specific to each airport were used in estimating emissions at airports.

Annual Average and Seasonal Inventories

An annual average inventory represents the emissions on an average day during a year. It is simply the total annual emissions in tons divided by 365 days. The emission inventory for the ozone season represents emissions occurring during the summer when ozone levels are highest. The emission inventory for CO season represents emissions occurring during the winter when CO levels are highest. The seasonal inventories (summer, winter) are prepared based on the ARB's published guidelines described below.

The point source emissions are based on "average annual operating day" during the year. Therefore the summer and winter point source emissions are the same. Area source emissions are based on "average seasonal operating day". The summer season is from May through October and the winter season is November through April. Data on normal operating schedules (hours per day, days per week and weeks per year) are collected as a part of routine point source inventory procedures. For area sources, representative profiles showing monthly, weekly, and daily variation in emissions are prepared for each source category. These profiles are then used to obtain average seasonal operating day emissions.

For on-road motor vehicles the planning version of BURDEN7F was used to develop planning inventories (also referred as seasonal inventories). The emission

estimates from these inventories are based on ambient temperature profiles representing the ten days having the highest pollutant levels. Summer temperature profiles are used to generate ozone-precursor (VOC and NO_x) emission inventory and winter temperature profiles are used for CO emissions.

BURDEN divides the day into six different time periods consistent with motor vehicle activity patterns, including morning and evening commuting. These six periods are 12-6 am, 6-9 am, 9 am-12 pm, 12-3 pm, 3-6 pm and 6 pm-12 am. For each period, specific temperatures, activity data and vehicle speeds are used and emissions estimated. The emissions from the six periods are then summed to get daily emissions.

The above calculations are carried out for each county. For Solano and Sonoma, only the portions under District jurisdiction are represented. As mentioned earlier, VMT, number of trips and speed distributions for each county were derived from data supplied by MTC. Vehicle population data and distribution of activity by vehicle class (passenger car, trucks, etc.) was based on DMV registration data supplied by ARB.

Inventory Projections

Baseline future year emissions for each source category are calculated from the base year (1990) emissions using the following equation:

$$EEM_{FY} = EM_{BY} \times CF \times GF$$

where:

- EM_{FY} is the forecasted emissions of an air pollutant for any future year,
- EM_{BY} represents the base year emissions of the air pollutant (1990 is the base year in this forecast),
- *CF* (Control Factor) is an indicator for the level of control imposed as a result of current State and regional air quality regulations, and
- *GF* (Growth Factor) is derived from best available data for the different source categories.

Control Factors. The impact of all adopted federal, State and regional air pollution control rules are included in emission forecasts by means of control factors. For an individual source category, a future year control factor CF is calculated by the equation:

$$CF_{FY} = \frac{E_{BY} - R}{E_{BY}}$$

where:

- E_{BY} is the base year 1990 emissions for a category affected by one or more of the rules,

- **R** is the sum of emission reductions from the applicable rules, and

- **CF** (Control Factor) is unity (i.e., equal to 1.0) for 1990 and less than one for years after 1990, if there are reductions from the rules.

Or control factor (CF) can be calculated by the equation:

$$CF_{FY} = \frac{100 - CE_{FY}}{100 - CE_{BY}}$$

where:

- CE_{BY} is the base year 1990 actual percent control efficiency (0 if none).

- CE_{FY} is the future year actual percent control efficiency.

The control factors in this inventory take into account all State and regional air quality regulations adopted prior to December 31, 1993.

For on-road motor vehicles, a separate methodology is used to project future emissions. Projected activity levels (trips and miles traveled) are used with future motor vehicle emission factors based on vehicle class, model and year.

PROPOSED FINAL

SAN FRANCISCO BAY AREA

BASE YEAR 1990 EMISSION INVENTORY

JULY 1994

Mailing Address:
Planning/Research Division
BAAQMD
939 Ellis Street
San Francisco, CA
94109

(415) 771-6000
Fax: (415) 928-8560

PROPOSED FINAL

SAN FRANCISCO BAY AREA

BASE YEAR 1990 EMISSION INVENTORY

JULY 1994

Mailing Address:
Planning/Research Division
BAAQMD
939 Ellis Street
San Francisco, CA
94109

(415) 771-6000
Fax: (415) 928-8560

PROPOSED FINAL BASE YEAR 1990 EMISSION INVENTORY

An emission inventory is an itemized list of emission estimates for sources of air pollution in a given area, for a specified time period. Present and future year inventories are critical components of air quality planning and modeling. The ultimate goal of the planning process is to identify and achieve an emission pattern which does not result in exceedance of ambient standards.

The BAAQMD began preparing emission inventories in 1957. The inventory is divided into stationary (point, area and biogenic) and mobile source emissions. Stationary source emissions are calculated by the BAAQMD using various procedures. Emission computation methodology by source categories is set forth in the BAAQMD publication "Source Category Methodology." There are more than 900 different categories used in this inventory. The BAAQMD participates in the California Emission Inventory Technical Advisory Committee (EITAC) and maintains the best available inventory methodologies. The Bay Area emissions (1990 totals), for Volatile Organic Compounds (VOC), Nitrogen Oxides (NOx) and Carbon monoxide (CO) are shown in Table 1 and also in Figure 1. The emissions by categories, are shown in Tables 2 and 3.

Table 1. Bay Area 1990 Emission Inventory

(Tons/Day)

	VOC	NOx	CO
Annual Average	635	511	3067
Summer Season	631	557	2865
Winter Season	705	553	3779

Stationary Source Emissions

Point Sources. Sources identified on an individual facility or source basis are called point sources. Refineries and industrial plants are examples of point sources. The emission characteristics of individual facilities vary widely and each facility is examined individually. The Permit Services Division of the BAAQMD collects and maintains detailed information on point sources. Almost all facilities emitting greater than 2.5 tons/year of any air pollutant are included in the computer data bank. The 1990 base year inventory accounts for about 3,900 facilities, with 20,000 different sources. There are about 35,000 different processes, because some sources have more than one process. Examples are: boilers burning different fuels, tanks storing different materials, and painting/printing operations using different coatings.

The data on the activity, seasonal variations, and hours of operation are collected at the process level from each facility. Parameters which affect the quantity of emissions are updated regularly. Emissions are calculated using the detailed data for each of the 7,000 processes listed as storage of organic liquid, and 10,000 processes listed as organic solvent users. The emissions from the combustion and other general processes are computed using generalized or specific emission factors. These factors are periodically reviewed and updated.

Area Sources. Those stationary sources which are not identified individually are called area sources. This term is sometimes extended to cover numerous small point sources such as dry cleaners or gas stations which are known (at least potentially) individually. It always includes the diverse, un-permitted small sources which individually do not emit significant amounts of pollutants but which together make an appreciable contribution to the emission inventory. Examples of area sources are residential heating and use of paints, varnishes and consumer products. Emissions from these sources are grouped into categories and calculated based on surrogate variables. Information on these surrogates is usually available for the State or by county. Emissions for some source categories are estimated by the California Air Resources Board (ARB) based on statewide data.

Many area source categories are further classified into sub-categories for better emission computation, regulation development, and future year projections. For example, emissions from aircraft categories are subdivided into various aircraft types at each of the airports in the Bay Area. Architectural coating categories are subdivided into various types of coatings and varnishes to account for varying solvent content.

Biogenic Sources. In addition to man-made air pollution, there are significant quantities of pollutants from natural sources such as plants, animals, marshes and the earth itself. Vegetation, for example, emits large amounts of isoprene, terpenes, and other organic compounds which are precursors of ozone. Emission rates depend upon species, season, biomass density, time of day, local temperature, moisture and other factors. Total reactive organic emissions from biogenic sources are about 300 tons per day. This estimate is obtained from the Personal Computer version of the Biogenic Inventory System (PC-BEIS) developed by the Environmental Protection Agency (EPA).

Mobile Source Emissions

Mobile sources consist of on-road motor vehicles and other sources, such as ships, aircraft, garden and construction equipment. Emissions from on-road motor vehicles are a major portion of the emissions inventory and are based on the procedures developed by ARB.

ARB uses EMFAC and BURDEN computer models for the development of the on-road motor vehicles emission inventory. EMFAC calculates emission rates for a variety of vehicle types (passenger cars, trucks, etc.), fuel, control technology and mode of operation. It also accounts for vehicle age, and operating conditions such as speed and

temperature. Emission factors are produced for summer and winter operations to reflect the type of fuel in use, such as winter-time oxygenated fuel and the summer-time fuel which has lower volatility (lower RVP) than winter. Emission reductions resulting from California's Inspection and Maintenance ("Smog Check") program are incorporated. The final draft version of EMFAC7F was used for this inventory.

BURDEN uses emission factors from EMFAC and a large data base of activity for each county to calculate total daily motor vehicle emissions. The activity data are in the form of the number of in-use vehicles, number of cold and hot starts and vehicle miles traveled (VMT) for each vehicle type. The activity data for these calculations are developed using MTC's regional travel model and supplemental calculations. The planning version of BURDEN7F was used for this inventory, and is described under the Seasonal Inventory section.

Various methodologies are used for compilation of the remaining mobile sources. Emission factors and methodologies for these sources are provided by ARB and EPA. Aircraft mix and activity data specific to each airport were used in estimating emissions at airports.

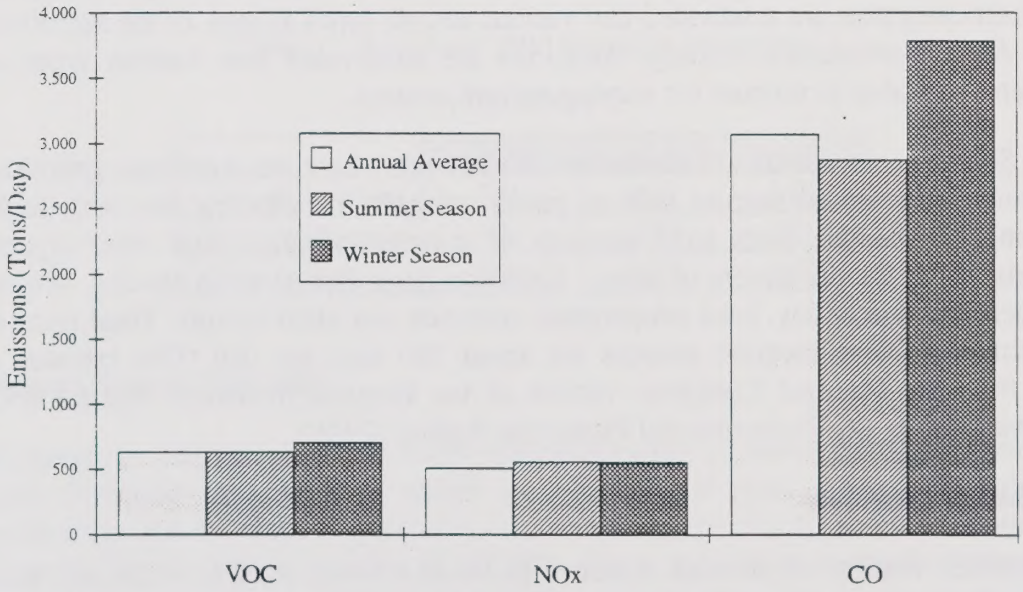

Figure 1. Bay Area 1990 Emission Inventory

Annual Average and Seasonal Inventory

An annual average inventory represents the emissions on an average day during a year. It is simply the total annual emissions in tons divided by 365 days. The emission inventory

for the ozone season represents emissions occurring during the summer season when ozone levels are highest. The emission inventory for the carbon monoxide season represents emissions occurring during the winter season when CO levels are highest. The seasonal inventories (summer, winter) are prepared based on the ARB's published guidelines described below.

The point source emissions are based on "average annual operating day" during the year. Therefore the summer and winter point source emissions are the same. Area source emissions are based on "average seasonal operating day". The summer season is from May through October and the winter season is November through April. Data on normal operating schedules (hours per day, days per week and weeks per year) are collected as a part of routine point source inventory procedures. For area sources, representative profiles showing monthly, weekly, and daily variation in emissions are prepared for each source category. These profiles are then used to obtain average seasonal operating day emissions.

For on-road motor vehicles the planning version of BURDEN7F was used to develop planning inventories (also referred to as seasonal inventories). The emission estimates from these inventories are based on ambient temperature profiles representing the ten days having the highest pollutant levels. Summer temperature profiles are used to generate ozone-precursor (VOC and NOx) emission inventory and winter temperature profiles are used for CO emissions.

BURDEN divides the day into six different time periods consistent with motor vehicle activity patterns, including morning and evening commuting. These six periods are 12-6am, 6-9 am, 9am-12pm, 12-3 pm, 3-6 pm and 6pm-12 am. For each period, specific temperatures, activity data and vehicle speeds are used and emissions estimated. The emissions from the six periods are then summed to get daily emissions.

The above calculations are carried out for each county. For Solano and Sonoma, only the portions under District jurisdiction are represented. As mentioned earlier, VMT, number of trips and speed distributions for each county were derived from data supplied by MTC. Vehicle population data and distribution of activity by vehicle class (passenger car, trucks, etc.) was based on DMV registration data supplied by ARB.

TABLE 2

EMISSIONS BY MAJOR SOURCE CATEGORIES

1990 Emission Inventory*

SOURCE CATEGORY	VOC (Tons/Day)			NOx (Tons/Day)		
	Annual Avg.	Summer	Winter	Annual Avg.	Summer	Winter
PETROLEUM REFINING FACILITIES						
Basic Refining Processes	0.11	0.11	0.11	9.70	9.91	9.91
Wastewater (Oil-Water) Separators	4.35	4.35	4.35	---	---	---
Wastewater Treatment Facilities	1.01	1.01	1.01	---	---	---
Cooling Towers	1.00	1.02	1.02	---	---	---
Flares and Blowdown Systems	0.08	0.08	0.08	1.15	1.15	1.15
Other Refining Processes	0.46	0.64	0.64	---	---	---
Fugitives	10.08	10.08	10.08	---	---	---
Subtotal	**17.1**	**17.3**	**17.3**	**10.9**	**11.1**	**11.1**
CHEMICAL MANUFACTURING FACILITIES						
Sulfur	0.02	0.02	0.02	0.05	0.05	0.05
Coatings & Inks	1.40	1.97	1.97	---	---	---
Resins	0.09	0.12	0.12	---	---	---
Pharmaceuticals & Cosmetics	0.48	0.48	0.48	---	---	---
Other Chemicals Mfg.	1.01	1.41	1.41	2.45	2.45	2.45
Fugitives (all mfg.)- Valves & Flanges	0.18	0.18	0.18	---	---	---
Subtotal	**3.2**	**4.2**	**4.2**	**2.5**	**2.5**	**2.5**
OTHER INDUSTRIAL/COMMERCIAL PROCESSES						
Bakeries	1.17	1.65	1.62	---	---	---
Cooking	1.05	1.22	0.88	---	---	---
Wineries	0.55	0.56	0.55	---	---	---
Other Food & Agricultural Processes	0.07	0.10	0.10	0.02	0.02	0.02
Metallurgical	0.06	0.09	0.09	0.03	0.04	0.04
Contaminated Soil Aeration	4.07	4.07	4.07	---	---	---
Soil Vapor Extraction & Air Stripping	0.10	0.11	0.11	---	---	---
Asphalt Concrete Plants	0.01	0.02	0.02	0.02	0.03	0.03
Glass & Related Products Mfg.	0.17	0.17	0.17	0.03	0.03	0.03
Semiconductor Manufacturing	0.79	0.92	0.92	---	---	---
Flexible & Rigid Discs Manufacturing	0.05	0.05	0.05	---	---	---
Fiberglass Products Manufacturing	0.73	1.02	1.02	---	---	---
Rubber Products Manufacturing	0.24	0.26	0.26	---	---	---
Plastic Products Manufacturing	0.21	0.30	0.30	---	---	---
Oil Production Fields	0.07	0.07	0.07	0.01	0.01	0.01
Gas Production Fields	0.09	0.09	0.09	0.01	0.01	0.01
Waste Management	3.59	3.60	3.60	0.15	0.15	0.15
Other Industrial Commercial	0.53	0.67	0.67	0.16	0.16	0.16
Subtotal	**13.6**	**15.0**	**14.6**	**0.4**	**0.4**	**0.4**
PETROLEUM REFINERY EVAPORATION						
Storage Tanks	5.60	5.60	5.60	---	---	---
Loading Operations	4.48	4.48	4.48	---	---	---
Subtotal	**10.1**	**10.1**	**10.1**	**---**	**---**	**---**
FUELS DISTRIBUTION						
Natural Gas Distribution	0.53	0.42	0.63	---	---	---
Bulk Plants	2.06	2.09	2.09	---	---	---
Loading Trucks	0.18	0.18	0.18	---	---	---
Trucking	14.86	15.10	14.62	---	---	---
Gasoline Filling Stations	2.26	2.43	2.12	---	---	---
Aircraft Fueling	1.07	1.12	1.01	---	---	---
Recreational Boat Fueling	---	---	---	---	---	---
Ships & Tugboats Fueling	0.01	0.01	0.01	---	---	---
Ferry & Fishing Boats Fueling	0.57	0.60	0.55	---	---	---
Subtotal	**21.5**	**22.0**	**21.2**	**---**	**---**	**---**

SOURCE CATEGORY	VOC (Tons/Day)			NOx (Tons/Day)		
	Annual Avg.	Summer	Winter	Annual Avg.	Summer	Winter
OTHER ORGANIC COMPOUNDS EVAPORATION						
Storage Tanks	1.65	1.66	1.64	---	---	---
Bulk Plants and Terminals (Non-Gasoline)	0.32	0.32	0.32	---	---	---
Lightering	0.95	0.99	0.91	---	---	---
Ballasting	0.88	0.88	0.88	---	---	---
Marine Vessel Cleaning & Gas Freeing	0.33	0.33	0.33	---	---	---
Sterilizers	0.28	0.33	0.33	---	---	---
Marine Loading (Non-Refinery)	0.96	0.98	0.98	---	---	---
Asphalt Paving	0.44	0.56	0.32	---	---	---
Industrial Degreasing	2.76	3.75	3.68	---	---	---
Commercial Degreasing	1.99	2.19	1.82	---	---	---
Dry Cleaners	0.24	0.32	0.32	---	---	---
Printing	6.23	7.12	7.16	---	---	---
Adhesives & Sealants	21.12	21.06	21.22	---	---	---
Structures Coating	28.25	30.85	25.65	---	---	---
Industrial/Commercial Coating	33.86	41.85	40.55	---	---	---
Other Organics Evaporation	1.08	1.51	1.51	---	---	---
Subtotal	**101.3**	**114.7**	**107.6**	**---**	**---**	**---**
COMBUSTION - STATIONARY SOURCES						
FUELS COMBUSTION						
Domestic	15.80	3.28	28.33	25.17	13.[illegible]	37.27
Cogeneration	0.89	0.93	0.93	11.64	12.03	12.03
Power Plants	0.25	0.25	0.25	27.65	27.82	27.82
Oil Refineries External Combustion	0.42	0.43	0.43	31.17	31.84	31.84
Reciprocating Engines	0.20	0.24	0.24	6.52	8.97	8.97
Turbines	0.10	0.13	0.13	1.87	2.21	2.21
Other External Combustion	0.81	0.88	0.90	24.56	33.97	34.01
Subtotal	**18.5**	**6.1**	**31.2**	**128.6**	**129.9**	**154.2**
BURNING OF WASTE MATERIAL						
Incineration	0.52	0.67	0.37	0.88	1.97	1.54
Planned Fires	0.05	0.03	0.07	---	---	---
Subtotal	**0.6**	**0.7**	**0.4**	**0.9**	**2.0**	**1.5**
COMBUSTION - MOBILE SOURCES						
OFF-HIGHWAY MOBILE SOURCES						
Lawn, Garden and Other Utility Equipment	8.12	11.58	4.67	0.39	0.55	0.23
Transportation Refrigeration Units	0.99	0.99	0.99	0.92	0.92	0.92
Farm Equipment	1.29	2.03	0.54	5.62	8.88	2.36
Heavy Duty Industrial/Construction Equipme	12.07	21.47	12.34	53.91	95.86	55.10
Light Duty Industrial/Construction Equipme	3.14	5.59	3.21	6.32	11.25	6.46
Locomotive Operations	0.49	0.49	0.49	12.06	12.11	12.02
Off Road Motorcycles	0.44	0.44	0.44	0.03	0.04	0.02
All Terrain Vehicles	---	---	---	---	---	---
Four-wheel Drive Vehicles	0.15	0.15	0.15	0.10	0.09	0.11
Ships Maneuvering	0.23	0.24	0.23	0.73	0.74	0.71
Ships Berthing	0.42	0.45	0.40	2.35	2.48	2.21
Ships In-Transit	0.68	0.70	0.67	2.41	2.45	2.37
Commercial Boats	0.43	0.44	0.41	1.78	1.85	1.70
Recreational Boats	17.15	18.16	16.14	6.15	6.80	5.49
Subtotal	**45.6**	**62.7**	**40.7**	**92.8**	**144.0**	**89.7**
AIRCRAFT						
Commercial Aircraft	6.08	6.26	5.90	10.55	10.86	10.24
General Aviation	1.45	1.83	1.08	0.37	0.47	0.26
Military Aircraft	9.64	9.67	9.60	4.16	4.17	4.14
Agricultural Aircraft	---	---	---	---	---	---
Subtotal	**17.2**	**17.8**	**16.6**	**15.1**	**15.5**	**14.6**

SOURCE CATEGORY	VOC (Tons/Day)			NOx (Tons/Day)		
	Annual Avg.	Summer	Winter	Annual Avg.	Summer	Winter
ON ROAD MOTOR VEHICLES						
Light Duty Passenger	232.81	210.18	278.05	139.58	132.45	153.85
Light And Medium Duty Trucks	67.55	61.79	79.39	48.69	46.66	52.76
Heavy Duty Trucks	22.34	22.67	21.83	66.21	66.32	66.06
Heavy Duty Buses	0.87	0.88	0.88	5.01	5.01	5.01
Motorcycles-Non Catalytic	3.90	4.07	3.76	0.74	0.70	0.78
Subtotal	**327.5**	**299.6**	**383.9**	**260.2**	**251.1**	**278.5**
MISCELLANEOUS OTHER SOURCES						
Accidental Fires	0.35	0.50	0.20	0.12	0.15	0.09
Animal Waste	4.27	4.25	4.29	---	---	---
Creosote Application	0.41	0.41	0.41	---	---	---
Agricultural Pesticides	1.56	3.15	0.50	---	---	---
Non-Agricultural Pesticides	4.40	4.40	4.40	---	---	---
Consumer Products (no pesticides)	48.20	48.20	48.20	---	---	---
Subtotal	**59.3**	**61.0**	**58.1**	**0.1**	**0.2**	**0.1**
GRAND TOTAL	**635**	**631**	**705**	**511**	**557**	**553**

--- means less than 0.005

*Base Year 1990

VOC = Volatile Organic Compounds, exclude methane, ethane, PERC and other non-reactives

NOx = Nitrogen Oxides

Totals may not equal to sums of column entries due to rounding.

TABLE 3

EMISSIONS BY MAJOR SOURCE CATEGORIES

1990 Emission Inventory*

SOURCE CATEGORY	Carbon Monoxide (Tons/Day)		
	Annual Avg.	Summer	Winter
PETROLEUM REFINING FACILITIES			
Basic Refining Processes	---	---	---
Wastewater (Oil-Water) Separators	---	---	---
Wastewater Treatment Facilities	---	---	---
Cooling Towers	---	---	---
Flares and Blowdown Systems	0.55	0.55	0.55
Other Refining Processes	---	---	---
Fugitives	---	---	---
Subtotal	**0.5**	**0.5**	**0.5**
CHEMICAL MANUFACTURING FACILITIES			
Sulfur	0.04	0.04	0.04
Coatings & Inks	---	---	---
Resins	---	---	---
Pharmaceuticals & Cosmetics	---	---	---
Other Chemicals Mfg.	27.45	27.59	27.59
Fugitives (all mfg.)- Valves & Flanges	---	---	---
Subtotal	**27.5**	**27.6**	**27.6**
OTHER INDUSTRIAL/COMMERCIAL PROCESSES			
Bakeries	---	---	---
Cooking	---	---	---
Wineries	---	---	---
Other Food & Agricultural Processes	---	---	---
Metallurgical	0.01	0.01	0.01
Contaminated Soil Aeration	---	---	---
Soil Vapor Extraction & Air Stripping	---	---	---
Asphalt Concrete Plants	0.03	0.03	0.03
Glass & Related Products Mfg.	0.01	0.01	0.01
Semiconductor Manufacturing	---	---	---
Flexible & Rigid Discs Manufacturing	---	---	---
Fiberglass Products Manufacturing	---	---	---
Rubber Products Manufacturing	---	---	---
Plastic Products Manufacturing	---	---	---
Oil Production Fields	---	---	---
Gas Production Fields	---	---	---
Waste Management	0.01	0.01	0.01
Other Industrial Commercial	---	---	---
Subtotal	**0.1**	**0.1**	**0.1**
PETROLEUM REFINERY EVAPORATION			
Storage Tanks	---	---	---
Loading Operations	---	---	---
Subtotal	**---**	**---**	**---**
FUELS DISTRIBUTION			
Natural Gas Distribution	---	---	---
Bulk Plants	---	---	---
Loading Trucks	---	---	---
Trucking	---	---	---
Gasoline Filling Stations	---	---	---
Aircraft Fueling	---	---	---
Recreational Boat Fueling	---	---	---
Ships & Tugboats Fueling	---	---	---
Ferry & Fishing Boats Fueling	---	---	---
Subtotal	**---**	**---**	**---**

SOURCE CATEGORY	Carbon Monoxide (Tons/Day)		
	Annual Avg.	Summer	Winter
OTHER ORGANIC COMPOUNDS EVAPORATION			
Storage Tanks	---	---	---
Bulk Plants and Terminals (Non-Gasoline)	---	---	---
Lightering	---	---	---
Ballasting	---	---	---
Marine Vessel Cleaning & Gas Freeing	---	---	---
Sterilizers	---	---	---
Marine Loading (Non-Refinery)	---	---	---
Asphalt Paving	---	---	---
Industrial Degreasing	---	---	---
Commercial Degreasing	---	---	---
Dry Cleaners	---	---	---
Printing	---	---	---
Adhesives & Sealants	---	---	---
Structures Coating	---	---	---
Industrial/Commercial Coating	---	---	---
Other Organics Evaporation	---	---	---
Subtotal	---	---	---
COMBUSTION - STATIONARY SOURCES			
FUELS COMBUSTION			
Domestic	187.28	39.91	334.66
Cogeneration	4.08	4.23	4.23
Power Plants	6.01	6.03	6.03
Oil Refineries External Combustion	6.07	6.17	6.17
Reciprocating Engines	5.02	5.66	5.66
Turbines	0.87	1.11	1.11
Other External Combustion	12.61	15.24	15.27
Subtotal	**222.0**	**78.4**	**373.2**
BURNING OF WASTE MATERIAL			
Incineration	2.17	3.24	2.01
Planned Fires	0.60	0.39	0.81
Subtotal	**2.8**	**3.6**	**2.8**
COMBUSTION - MOBILE SOURCES			
OFF-HIGHWAY MOBILE SOURCES			
Lawn, Garden and Other Utility Equipment	86.12	122.28	49.96
Transportation Refrigeration Units	0.90	0.90	0.90
Farm Equipment	11.66	18.43	4.90
Heavy Duty Industrial/Construction Equipme	6.83	12.14	6.98
Light Duty Industrial/Construction Equipme	234.98	417.79	240.15
Locomotive Operations	1.61	1.62	1.61
Off Road Motorcycles	11.20	14.33	8.06
All Terrain Vehicles	3.86	3.86	3.86
Four-wheel Drive Vehicles	1.63	1.47	1.80
Ships Maneuvering	0.14	0.14	0.14
Ships Berthing	0.50	0.53	0.47
Ships In-Transit	0.42	0.43	0.42
Commercial Boats	1.33	1.36	1.30
Recreational Boats	91.17	95.72	86.62
Subtotal	**452.3**	**691.0**	**407.1**
AIRCRAFT			
Commercial Aircraft	16.04	16.51	15.57
General Aviation	31.29	39.62	22.96
Military Aircraft	14.56	14.61	14.51
Agricultural Aircraft	0.15	0.22	0.07
Subtotal	**62.0**	**71.0**	**53.1**

SOURCE CATEGORY	Carbon Monoxide (Tons/Day)		
	Annual Avg.	Summer	Winter
ON ROAD MOTOR VEHICLES			
Light Duty Passenger	1652.11	1398.23	2159.88
Light And Medium Duty Trucks	417.36	359.78	532.52
Heavy Duty Trucks	206.70	209.58	200.94
Heavy Duty Buses	4.31	4.31	4.31
Motorcycles-Non Catalytic	12.30	12.18	12.55
Subtotal	**2292.8**	**1984.1**	**2910.2**
MISCELLANEOUS OTHER SOURCES			
Accidental Fires	6.43	8.90	3.96
Animal Waste	---	---	---
Sanitary Sewers	---	---	---
Creosote Application	---	---	---
Agricultural Pesticides	---	---	---
Non-Agricultural Pesticides	---	---	---
Consumer Products (no pesticides)	---	---	---
Subtotal	**6.4**	**9.0**	**4.0**
GRAND TOTAL	**3067**	**2865**	**3779**

--- means less than 0.005

*Base Year 1990

Totals may not equal to sums of column entries due to rounding.